JAVA + DSA +OOPs

1. Complete Git & GitHub Course

2. Introduction to Programming
    - Types of languages
    - Memory management

3. Flow of the program
    - Flowcharts
    - Pseudocode

4. Introduction to Java
    - Introduction
    - How it works
    - Setup Installation
    - Input and Output in Java
    - **Conditionals** & **Loops** in Java
        - if else
        - loops
        - Switch statements
    - Data types
    - Coding best practices

5. Functions
    - Introduction
    - Scoping in Java
    - Shadowing
    - Variable Length Arguments
    - Overloading

6. Arrays
    - Introduction
    - Memory management
    - Input and Output
    - ArrayList Introduction
    - **Sorting**
        - Insertion Sort
        - Selection Sort
        - Bubble Sort
        - Cyclic Sort (Merge sort etc after recursion)
    - **Searching**
        - Linear Search
        - Binary Search
        - Modified Binary Search
        - Binary Search Interview questions
        - Binary Search on 2D Arrays

7. Pattern questions

8. Strings
    - Introduction
    - How Strings work
    - Comparison of methods
    - Operations in Strings
    - StringBuilder in java

9. Maths for DSA

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- Introduction
- Complete Bitwise Operators
- Prime numbers
- HCF / LCM
- Sieve of Eratosthenes
- Newton's Square Root Method
- Number Theory
- Euclidean algorithm

10. **Space and Time Complexity Analysis**
    - Introduction
    - Comparion of various cases
    - Solving Linear Recurrence Relations
    - Solving Divide and Conquer Recurrence Relations
    - Big-O, Big-Omega, Big-Theta Notations
    - Get equation of any relation easily - best and easiest approach
    - Complexity discussion of all the problems we do
    - Space Complexity
    - Memory Allocation of various languages
    - NP Completeness and Hardness

11. **Recursion**
    - Introduction
    - Why recursion?
    - Flow of recursive programs - stacks
    - Convert recursion to iteration
    - Tree building of function calls
    - Tail recursion
    - **Sorting:**
        - Merge Sort
        - Quick Sort
    - **Backtracking**
        - Sudoku Solver
        - N-Queens
        - N-Knights
        - Maze problems
    - Recursion String Problems
    - Recursion Array Problems
    - Recursion Pattern Problems
    - Subset Questions
    - Recursion - Permutations, Dice Throws etc Questions

12. **Object Oriented Programming**
    - Introduction
    - Classes & its instances
    - this keyword in Java
    - **Properties**
        - Inheritance
        - Abstraction
        - Polymorphism
        - Encapsulation
    - Overloading & Overriding
    - Static & Non-Static
    - Access Control
    - Interfaces
    - Abstract Classes
    - Singleton Class
    - final, finalize, finally
    - Exception Handling

13. **Linked List**
    - Introduction

- Singly and Doubly Linked List
- Circular Linked List
- Fast and slow pointer
- Cycle Detection
- Reversing of LinekdList
- Linked List Interview questions

14. Stacks & Queues
    - Introduction
    - Interview problems
    - Push efficient
    - Pop efficient
    - Queue using Stack and Vice versa
    - Circular Queue

15. Dynamic Programming
    - Introduction
    - Recursion + Recursion DP + Iteration + Iteration Space Optimized
    - Complexity Analysis
    - 0/1 Knapsack
    - Subset Questions
    - Unbounded Knapsack
    - Subseq questions
    - String DP

16. Trees
    - Introduction
    - Binary Trees
    - Binary Search Trees
    - DFS
    - BFS
    - AVL Trees
    - Segment Tree
    - Fenwick Tree / Binary Indexed Tree

17. Heaps
    - Introduction
    - Theory
    - Priority Queue
    - Two Heaps Method
    - k-way merge
    - top k elements
    - interval problems

18. Hashmaps
    - Introduction
    - Theory - how it works
    - Comparisons of various forms
    - Limitations and how to solve
    - Map using LinkedList
    - Map using Hash
    - Chaining
    - Probing
    - Huffman-Encoder

19. Tries

20. Graphs
    - Introduction
    - BFS
    - DFS

        - Working with graph components
        - Minimum Spanning Trees
        - Kruskal Algorithm
        - Prims Algorithm
        - Dijkstra's shortest path algorithm
        - Topological Sort
        - Bellman ford
        - A* pathfinding Algorithm

21. Greedy Algorithms

Advanced concepts apart from interviews

- Fast IO
- File handling
- Bitwise + DP
- Extended Euclidean algorithm
- Modulo Multiplicative Inverse
- Linear Diophantine Equations
- Matrix Exponentiation
- Mathematical Expectation
- Catalan Numbers
- Fermat's Theorem
- Wilson's Theorem
- Euler's Theorem
- Lucas Theorem
- Chinese Remainder Theorem
- Euler Totient
- NP-Completeness
- Multithreading
- Fenwick Tree / Binary Indexed Tree
- Square Root Decomposition